

lines 16-21 of the specification). However, issues as to catalyst stability and induction time remain such that improved methods are sought.

The claimed invention addresses this problem by providing a method for preparing at least one alkoxylate by contacting at least one alkylene oxide with a **Guerbet alcohol** in the presence of at least one double metal cyanide compound, at a **temperature of from 140-155 °C**. Applicants have discovered that such a temperature range provides for good induction times and good catalyst stability in the reaction of a Guerbet alcohol. Such a method is nowhere disclosed or suggested in the cited prior art of record.

The rejection of claims 10, 14, 15, and 18 under 35 U.S.C. § 103(a) over Kosmin (U.S. 2,508,036) in view of Clement et al. (U.S. 6,429,324) is respectfully traversed.

The examiner has relied upon Clement et al. as teaching a process of ethoxylation of an initiator compound in the presence of a double metal cyanide catalyst wherein the reaction temperature is described as from 25°C to up to 150 °C or more, preferably 50-130 °C and more preferably about 70-120 °C (column 3, lines 54-59). The examiner cites to column 2, lines 58-67 for a disclosure that the “induction period” may range from a few minutes to several hours depending on the particular catalyst and the temperature used. There is no disclosure of the effect of temperature on both the induction time and catalyst stability.

Applicants have discovered that a temperature range of **from 140-155 °C** in the reaction of a Guerbet alcohol to be a temperature which exhibits short induction times without adversely effecting catalyst stability.

As evidence of such improved results for the temperature range of 140-155 °C in the reaction of a Guerbet alcohol, the examiner’s attention is directed to Comparative Example 1 in which 2-propyl-1 heptanol, a Guerbet alcohol, is reacted with ethylene oxide with a double metal cyanide catalyst. The induction times were measured at 100 °C, 120 °C, 140 °C and 160 °C.

<i>Temperature</i>	<i>Induction time</i>
100°C	Did not start
120°C	20 min
140°C	5 min
160°C	5 min

At a temperature of 100 °C, the reaction did not start, while at 120 °C, the reaction exhibited a 20 minute induction time. In contrast, at a temperature of 140 °C, within the claimed range, the induction time was reduced to only 5 minutes. Applicants further note, that at 160 °C, the induction time was also 5 minutes.

Comparative Examples 2 and 3 illustrate reaction and induction at 160 °C wherein the addition of ethylene oxide was stopped because reaction could not longer be detected. This is evidence of reduced catalyst stability. In Comparative Example 2, 8 mols of ethylene oxide were desired to be added however only about 81% was added before reaction could no longer be detected. In Comparative Example 3, after addition of 1.2 mols of propylene oxide, a desired 6 mols of ethylene oxide was prematurely terminated after about 84% addition.

In contrast, Examples 1 and 2, conducted at 140 °C went to completion. Thus, applicants have discovered and demonstrated a temperature range which gives both a rapid induction time and high catalyst stability, properties which are not observed throughout the broad range of 25 – 150 °C or more, as disclosed by Clement et al. Clement et al. makes no disclosure of any relationship between the reaction temperature and catalyst stability and accordingly applicants' discovery of a temperature range of 140-155 °C which has both good induction time and catalyst stability is an improved result relative to the disclosure of Clement et al.

Applicants note that the comparison showing improvements for the claimed temperature range of 140-155°C for Guerbet alcohol is appropriate as Clement et al. does not illustrate reaction of Guerbet alcohol and only illustrates reaction temperatures of 90, 100, 120 and 130. There is no illustration of reaction of Guerbet alcohol or a temperature of from

140 to 155°C. There is no basis to focus the disclosure in Clement et al of a temperature of 150°C to react Guerbet alcohol as the reference provides a generic disclosure of alcohol substrates and a broad range of reaction temperatures.

Further the reference's generic range of reaction temperatures of from 25 to up to 150°C along with illustrative examples at 90, 100, 120 and 130°C treats all of these reaction temperatures as the same. The reference provides an expectation of equal performance for any temperature within the broad range of from 25 to 150°C. Therefore applicants' demonstration of improved results by selection of a temperature of 140-155° for the reaction of Guerbet alcohols is most appropriate. The claimed invention has only been held to be obvious as it fails to specify the claimed Guerbet alcohol or the specific temperature range of 140 to 155°C. Applicants' demonstration of decreased performance at temperatures of 100, 120 and 160°C for the specific reaction of Guerbet alcohol demonstrates such a selection.

Applicants also note that Guerbet alcohols are obtained from the Guerbet reaction in which primary or secondary alcohols are condensed at high temperatures and pressure in the presence of alkali metal hydroxides or alkoxides. A characteristic feature of Guerbet alcohols is a relatively long straight alkyl chain having the hydroxy group in position 1 and having a shorter alkyl substituent in the 2-position (e.g 2-ethyl hexanol, 2-propyl heptanol or 2-butyl octanol.)

In contract, Clement et al describes alcohols having different substituents in the 2-position like 1-t-butoxy-2-propanol or having a short straight chain as a main chain, like t-butanol or 2-methyl-2-propanol. Although Clement et al discloses that any initiator having reactive hydrogen atoms may be used, this does not suggest that Guerbet alcohols would provide such an improvement in production by the claimed process.

Kosmin is merely cited to disclose the reaction of a Guerbet alcohol but fails to disclose or suggest the use of a double metal cyanide catalyst or the temperature range of

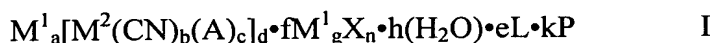
140-155 °C providing for reduced induction time and high catalyst stability. As the cited references fail to disclose or suggest the results obtained for this temperature range, the claimed invention is not obvious from these references and accordingly withdrawal of the rejections under 35 U.S.C. § 103(a) is respectfully requested.

The rejection of claims 10-13 and 16 under 35 U.S.C. 103(a) over Clement et al. US. 6,429,342 is believed to be moot as applicants have introduced the limitation of claim 14, which has not been rejected over this reference. Withdrawal of this ground of rejection is respectfully requested.

The provisional rejection of claims 10-20 on the grounds of nonstatutory obviousness-type double patenting over claims 1-4 and 9 of co-pending Application 10/528,414 is respectfully traversed.

Claims 1-18 of U.S. 10/528,414 as allowed on November 29, 2006 are reproduced below:

Claim 1. A process for the preparation of at least one alkoxylate comprising:  
 bringing into contact an alkylene oxide mixture comprising ethylene oxide with at least one starter compound in the presence of at least one double-metal cyanide compound of the formula 1:



wherein

$M^1$  is a metal ion selected from the group consisting of  $Zn^{2+}$ ,  $Fe^{3+}$ ,  $Co^{3+}$ ,  $Ni^{2+}$ ,  $Mn^{2+}$ ,  $Co^{2+}$ ,  $Sn^{2+}$ ,  $Pb^{2+}$ ,  $Mo^{4+}$ ,  $Mo^{6+}$ ,  $Al^{3+}$ ,  $V^{4+}$ ,  $V^{5+}$ ,  $Sr^{2+}$ ,  $W^{4+}$ ,  $W^{6+}$ ,  $Cr^{2+}$ ,  $Cr^{3+}$ ,  $Cd^{2+}$ ,  $Hg^{2+}$ ,  $Pd^{2+}$ ,  $Pt^{2+}$ ,  $V^{2+}$ ,  $Mg^{2+}$ ,  $Ca^{2+}$ ,  $Ba^{2+}$ ,  $Cu^{2+}$ ,  $La^{3+}$ ,  $Ce^{3+}$ ,  $Ce^{4+}$ ,  $Eu^{3+}$ ,  $Ti^{3+}$ ,  $Ti^{4+}$ ,  $Ag^+$ ,  $Rh^{2+}$ ,  $Rh^{3+}$ ,  $Ru^{2+}$ , and  $Ru^{3+}$ ;

$M^2$  is a metal ion selected from the group consisting of  $Fe^{2+}$ ,  $Fe^{3+}$ ,  $Co^{2+}$ ,  $Co^{3+}$ ,  $Mn^{2+}$ ,  $Mn^{3+}$ ,  $V^{4+}$ ,  $V^{5+}$ ,  $Cr^{2+}$ ,  $Cr^{3+}$ ,  $Rh^{3+}$ ,  $Ru^{2+}$ , and  $Ir^{3+}$ ;

A and X, independently of one another, are anions, each of which is selected from the group consisting of halide, hydroxide, sulfate, carbonate, cyanide, thiocyanate, isocyanate, cyanate, carboxylate, oxalate, nitrate, nitrosyl, hydrogensulfate, phosphate, dihydrogenphosphate, hydrogenphosphate or and hydrogencarbonate;

L is a water-miscible lagand selected from the group consisting of alcohols, aldehydes, ketones, ethers, polyethers, esters, polyesters, polycarbonate, ureas, amides, primary, secondary and tertiary amines, ligands with pyridine nitrogen, nitriles, sulfides, phosphides, phosphates, phosphines, phosphonates and phosphates;

k is a fraction or an integer, wherein the value of k is greater than or equal to zero;

P is at least one organic additive selected from the group consisting of polyethers, polyesters, polycarbonates, polyalkylene glycol sorbitan esters, polyalkylene glycol glycidyl ethers, polyacrylamide, poly(acrylamide-co-acrylic acid), polyacrylic acid, poly(acrylamide-co-maleic acid), polyacrylonitrile, polyalkyl acrylates, polyalkyl methacrylates, polyvinyl methyl ether, polyvinyl ethyl ether, polyvinyl acetate, polyvinyl alcohol, poly-N-vinylpyrrolidone, poly(N-vinylpyrrolidone-co-acrylic acid), polyvinyl methyl ketone, poly(4-vinylphenol), poly(acrylic acid-co-styrene), oxazoline polymers, polyalkyleneimines, maleic acid and maleic anhydride copolymers, hydroxyethylcellulose, polyacetates, ionic surface-active and interface-active compounds, bile acid or salts thereof, esters or amides, carboxylic esters of polyhydric alcohols, and glycosides;

a, b, c, d, g and n are chosen such that the electroneutrality of the compound I is ensured;

e is the number of ligand molecules, wherein e is a fraction or an integer, and wherein the value of e is greater than or equal to 0; and

each of f and h, independently of one another, is a fraction or an integer wherein each of f and h, independently of each other, has a value greater than or equal to 0;

wherein, during the induction phase, the sum of the inert gas partial pressure and the ethylene oxide partial pressure is 1.5 bar to 6.0 bar; and wherein the starter compound is a Guerbet alcohol.

Claim 2. The process of claim 1, wherein the total pressure does not exceed 11 bar over the course of the reaction.

Claim 3. The process of claim 1, wherein:

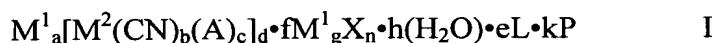
(1)  $M^1$  is selected from the group consisting of  $Zn^{2+}$ ,  $Fe^{2+}$ ,  $Fe^{3+}$ ,  $Co^{3+}$ ,  $Ni^{2+}$ ,  $Mn^{2+}$  and  $CO^{2+}$ ; or

(2)  $M^2$  is selected from the group consisting of  $Fe^{6+}$ ,  $Fe^{3+}$ , and  $Co^{3+}$ .

Claim 4. The process of claim 1, wherein  $M^1$  is  $Zn^{2+}$  and  $M^2$  is  $Co^{3+}$ .

Claim 5. The process of claim 1, wherein the double-metal cyanide compound catalyst is crystalline.

Claim 6. A process for the preparation of at least one alkoxylate comprising:  
 bringing into contact an alkylene oxide mixture comprising ethylene oxide with at least one starter compound in the presence of at least one double-metal cyanide compound of the formula 1:



wherein

$M^1$  is a metal ion selected from the group consisting of  $Zn^{2+}$ ,  $Fe^{3+}$ ,  $Co^{3+}$ ,  $Ni^{2+}$ ,  $Mn^{2+}$ ,  $Co^{2+}$ ,  $Sn^{2+}$ ,  $Pb^{2+}$ ,  $Mo^{4+}$ ,  $Mo^{6+}$ ,  $Al^{3+}$ ,  $V^{4+}$ ,  $V^{5+}$ ,  $Sr^{2+}$ ,  $W^{4+}$ ,  $W^{6+}$ ,  $Cr^{2+}$ ,  $Cr^{3+}$ ,  $Cd^{2+}$ ,  $Hg^{2+}$ ,  $Pd^{2+}$ ,  $Pt^{2+}$ ,  $V^{2+}$ ,  $Mg^{2+}$ ,  $Ca^{2+}$ ,  $Ba^{2+}$ ,  $Cu^{2+}$ ,  $La^{3+}$ ,  $Ce^{3+}$ ,  $Ce^{4+}$ ,  $Eu^{3+}$ ,  $Ti^{3+}$ ,  $Ti^{4+}$ ,  $Ag^+$ ,  $Rh^{2+}$ ,  $Rh^{3+}$ ,  $Ru^{2+}$ , and  $Ru^{3+}$ ;

$M^2$  is a metal ion selected from the group consisting of  $Fe^{2+}$ ,  $Fe^{3+}$ ,  $Co^{2+}$ ,  $Co^{3+}$ ,  $Mn^{2+}$ ,  $Mn^{3+}$ ,  $V^{4+}$ ,  $V^{5+}$ ,  $Cr^{2+}$ ,  $Cr^{3+}$ ,  $Rh^{3+}$ ,  $Ru^{2+}$ , and  $Ir^{3+}$ ;

A and X, independently of one another, are anions, each of which is selected from the

group consisting of halide, hydroxide, sulfate, carbonate, cyanide, thiocyanate, isocyanate, cyanate, carboxylate, oxalate, nitrate, nitrosyl, hydrogensulfate, phosphate, dihydrogenphosphate, hydrogenphosphate or and hydrogencarbonate;

L is a water-miscible lagand selected from the group consisting of alcohols, aldehydes, ketones, ethers, polyethers, esters, polyesters, polycarbonate, ureas, amides, primary, secondary and tertiary amines, ligands with pyridine nitrogen, nitriles, sulfides, phosphides, phosphates, phosphines, phosphonates and phosphates;

k is a fraction or an integer, wherein the value of k is greater than or equal to zero;

P is an organic additive,

a, b, c, d, g and n are chosen such that the electroneutrality of the compound

I is ensured;

e is the number of ligand molecules, wherein e is a fraction or an integer, and wherein the value of e is greater than or equal to 0; and

each of f and h, independently of one another, is a fraction or an integer wherein each of f and h, independently of each other, has a value greater than or equal to 0;

wherein, during the induction phase, the sum of the inert gas partial pressure and the ethylene oxide partial pressure is 1.5 bar to 6.0 bar; and wherein the starter compound is a Guerbet alcohol,

wherein the alkylene oxide mixture has an ethylene oxide fraction of more than 99%.

Claim 7. An alkoxylate obtained by the process of claim 1.

Claim 8. The process of claim 1, wherein c has a value of 0.

Claim 9. The process of claim 1, wherein

(1)  $M^1$  is selected from the group consisting of  $Zn^{2+}$ ,  $Fe^{3+}$ ,  $Fe^{3+}$ ,  $Co^{3+}$ ,  $Ni^{2+}$ ,  $Mn^{2+}$  and  $Co^{2+}$ ; and

(2)  $M^2$  is selected from the group consisting of  $Fe^{2+}$ ,  $Fe^{3+}$ , and  $Co^{3+}$ .

Claim 10. The process of claim 1, wherein the alkylene oxide mixture has an ethylene oxide fraction of more than 99%.

Claim 11. The process of claim 1, wherein e is greater than zero.

Claim 12. The process of claim 1, wherein f is greater than zero.

Claim 13. The process of claim 1, wherein g is greater than zero.

Claim 14. The process of claim 1, wherein k is greater than zero.

Claim 15. The process of claim 1, wherein e is zero.

Claim 16. The process of claim 1, wherein f is zero.

Claim 17. The process of claim 1, wherein g is zero.

Claim 18. The process of claim 1, wherein k is zero.

None of the claims of U.S. 10/528,414 disclose or suggest a temperature range of 140-155 °C. None of the claims of U.S. '414 disclose a reduced induction time with high catalyst stability for the temperature range of 140-155 °C. As such, the claimed subject matter would not have been obvious from claim 1-4 and 9 of U.S. '414 as there is neither the disclosure of applicants' claim limitation of a temperature range of 140-155 °C nor the improved result of reduced induction time with high catalyst stability. As such, the claimed invention would not have been obvious from claims 1-4 and 9 of U.S. '414 and withdrawal of the provisional ground of rejection for nonstatutory obviousness-type double patenting is respectfully requested.



Applicants submit this application is now in condition for allowance and early notification of such action is earnestly solicited.

Respectfully submitted,

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